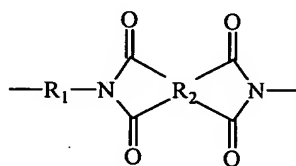


5 What is claimed is

1. A method for processing a feed mixture of two or more gases wherein said feed mixture contains at least one C<sub>5</sub>+ hydrocarbon component, said method comprising:

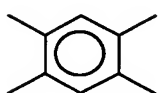
(a) providing a selectively permeable membrane wherein said membrane comprises a first side and a second side;

10 (b) wherein said membrane further comprises at least one polymer or copolymer comprising repeating units of formula (I):

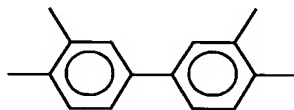


(I)

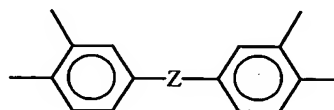
15 in which R<sub>2</sub> is a moiety having a composition selected from the group of consisting of formula (A), formula (B), formula (C), and mixtures thereof,



(A)

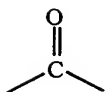


(B)

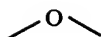


(C)

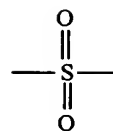
20 in which Z is a moiety having a composition selected from the group consisting of formula (L), formula (M), formula (N) and mixtures thereof,



(L)



(M)



(N)

5

(c) contacting the first side of the membrane with said gaseous feed mixture of at least two or more gas components;

10

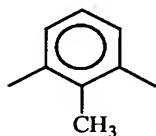
(d) causing at least one component of the feed mixture to selectively permeate through the membrane, thereby forming on the second side of the membrane a permeate composition which has a concentration of at least one component that is greater than the concentration of the feed mixture;

(e) removing from the second side of the membrane the permeate composition; and

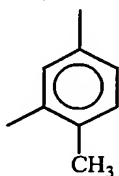
15

(f) withdrawing from the first side of the membrane a composition which has a concentration of at least one component that is less than the concentration of the feed mixture.

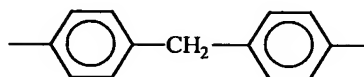
2. The method of claim 1, wherein  $R_1$  is a moiety having a composition selected from the group consisting of formula (Q), formula (S), formula (T):



(Q)



(S)



(T)

20 and mixtures thereof.

5           3.       The method of claim 1, wherein the feed mixture further comprises at least hydrogen and methane.

          4.       The method of claim 1, wherein the feed mixture further comprises at least carbon dioxide and methane.

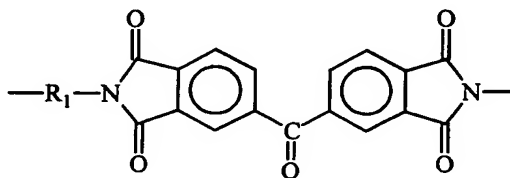
          5.       The method of claim 1, wherein the feed mixture further comprises at least  
10   nitrogen and methane.

          6.       The method of claim 1, further comprising the steps of repeating steps (a)-(d) continuously or nearly continuously for at least about 200 hours of operation, wherein after about 200 hours of operation, the membrane exhibits a permeance for the more permeable gas that is at least about 70 % of the permeance at an initial time of use.

15           7.       The method of claim 1, wherein said membrane comprises a composite hollow fiber membrane comprising a supporting core layer and a gas-separating sheath layer.

          8.       The method of claim 1, wherein said feed mixture further comprises at least one olefin and at least one paraffin, and wherein at least one olefin is separated from said  
20   mixture.

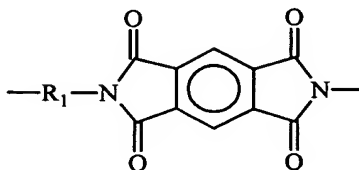
          9.       The method of claim 1, wherein the repeating units of formula (I) comprise repeating units of formula (Ia):



(Ia)

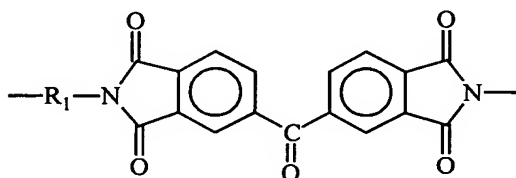
          10.      The method of claim 9, wherein R<sub>1</sub> is comprised of formula (Q) in about 0%-100% of the repeating units, formula (S) is about 0%-100% of the repeating units, and  
30   formula (T) in about 0%-100% of the repeating units.

- 5            11. The method of claim 1, wherein the repeating units of formula (I) comprise repeating units of formula (Ib):

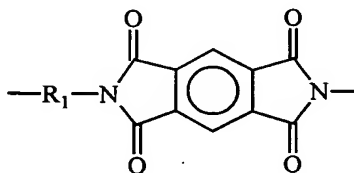


(Ib)

12. The method of claim 2, wherein the repeating units of formula (I) comprise repeating units having a composition of formula (Ia) and repeating units having a composition of formula (Ib):
- 10



(Ia)



(Ib)

wherein units of formula (Ib) comprise about 1 – 99% of the total repeating units of formulas (Ia) and (Ib).

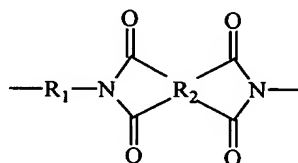
13. The method of claim 12, wherein R<sub>1</sub> is comprised of formula (Q) in about 1-99% of the repeating units, and wherein R<sub>1</sub> is comprised of formula (S) in a complementary amount so as to total 100%.
- 15

14. The method of claim 12, in which the moiety R<sub>1</sub> has a composition of formula (Q) in about 20% of the repeating units, wherein the moiety R<sub>1</sub> has a composition of formula (S) in about 80% of the repeating units, and wherein repeating units of formula (Ib) comprise about 40% of the total of repeating units of formulas (Ia) and (Ib) in formula (I).
- 20

5        15.    The method of claim 1, wherein at least one C<sub>5+</sub> hydrocarbon component condenses in liquid form on the first side of the membrane and wherein said first side comprises the feed side of the membrane.

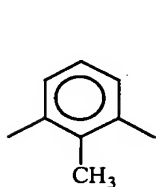
16.    A method for processing a feed mixture of two or more gases wherein said mixture contains at least one C<sub>5+</sub> hydrocarbon component, said method comprising:

10        (a) providing a gas separation membrane having a first side and a second side, said membrane comprising a blend of at least one polymer of a Type 1 copolyimide and at least one polymer of a Type 2 copolyimide in which the Type 1 copolyimide comprises repeating units of formula (I):

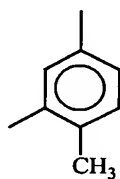


(I)

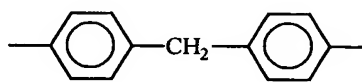
15        in which R<sub>1</sub> is a moiety having a composition selected from the group consisting of formula (Q), formula (S), formula (T), and mixtures thereof,



(Q)

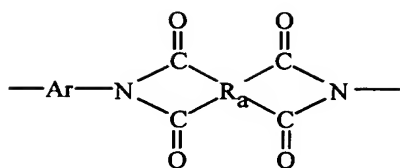


(S)

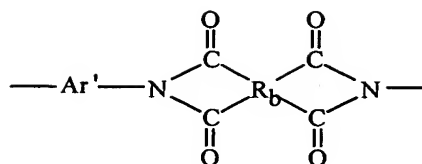


(T)

in which the Type 2 copolyimide comprises the repeating units of formulas (IIa) and (IIb)



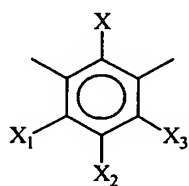
(IIa)



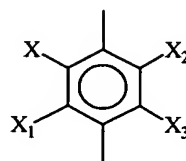
(IIb)

5

in which Ar is a moiety having a composition selected from the group consisting of formula (U), formula (V):



(U)



(V)

and mixtures thereof;

10 (b) contacting the first side of the membrane with a feed mixture comprising at least one C<sub>5+</sub> hydrocarbon component;

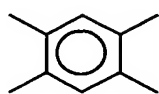
(c) causing one component of the feed mixture to selectively permeate through the membrane, thereby forming on the second side of the membrane a permeate composition which has a concentration of said one component greater than that of the feed mixture;

15

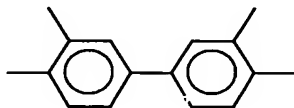
(d) removing from the second side of the membrane the permeate composition; and

(e) withdrawing from the first side of the membrane a composition which has a concentration of the one component that is less than that of the feed mixture.

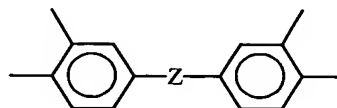
- 5      17.      The method of claim 16, wherein  $R_2$  is a moiety having a composition selected from the group consisting of formula (A), formula (B), formula (C) and mixtures thereof, and



(A)

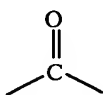


(B)

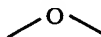


(C)

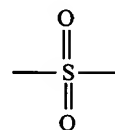
- 10      Z is a moiety having a composition selected from the group consisting of formula (L), formula (M), formula (N), and



(L)



(M)



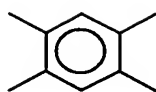
(N)

mixtures thereof.

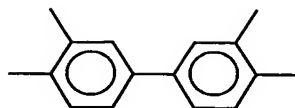
- 15      18.      The method of claim 16, wherein  $X$ ,  $X_1$ ,  $X_2$ ,  $X_3$  independently are hydrogen or an alkyl group having at least 1 to 6 carbon atoms, provided that at least two of  $X$ ,  $X_1$ ,  $X_2$ , or  $X_3$  on each of (U) and (V) are an alkyl group,

$Ar'$  is any aromatic moiety,

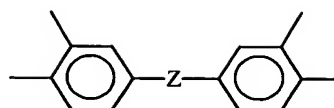
$R_a$  and  $R_b$  each independently have composition of formulas (A), (B), (C), (D), or mixtures thereof, and



(A)

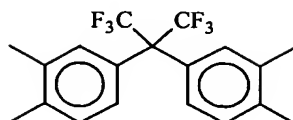


(B)



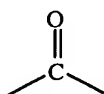
(C)

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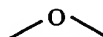


(D)

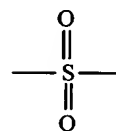
wherein Z is a moiety having composition selected from the group consisting of formula (L), formula (M), formula (N):



(L)



(M)



(N)

10 and mixtures thereof.

19. The method of claim 16, wherein the ratio of Type 1 polymer to Type 2 polymer in the blend is at least about 1.0.

20. The method of claim 16, wherein the feed mixture comprises at least hydrogen and methane.



5        21.     The method of claim 16, wherein the feed mixture comprises at least carbon dioxide and methane.

      22.     The method of claim 16, wherein the feed mixture comprises at least nitrogen and methane.

10       23.     The method of claim 16, wherein the feed mixture is selected from the group consisting of carbon dioxide; carbon monoxide; sulfide gases; hydrogen sulfide; paraffins; iso-paraffins; olefins; ozone; argon; chlorine; hydrogen; methane; nitrogen; carbon monoxide; propylene; propane; hexane; and a combination thereof.

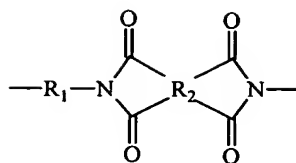
15       24.     The method of claim 16, further comprising the step of repeating steps (a)-(d) continuously or nearly continuously for at least about 200 hours of operation, wherein after about 200 hours of operation, the membrane exhibits a permeance for the more permeable gas that is at least about 70 % of the permeance at an initial time of usage.

      25.     The method of claim 16, wherein the membrane comprises a composite hollow fiber membrane comprised of a supporting core layer and a gas-separating sheath layer.

20       26.     The method of claim 16, wherein at least one C<sub>5+</sub> hydrocarbon component condenses in liquid form on the first side of the membrane and wherein said first side comprises the feed side of the membrane.

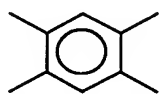
      27.     A method for processing a feed mixture of two or more gases wherein said feed mixture contains at least one C<sub>5+</sub> hydrocarbon component, said method comprising:

25       (a)     providing a composite selectively permeable membrane comprising a corelayer with at least a first side and a second side and a gas-separating sheath layer wherein the core layer comprises a polymer or copolymer comprising repeating units of formula (I):

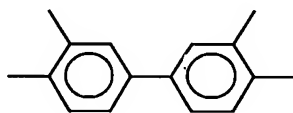


(I)

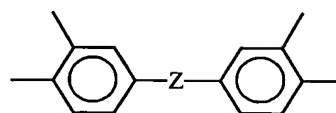
in which  $R_2$  is a moiety having a composition selected from the group of consisting of formula (A), formula (B), formula (C) and mixtures thereof,



(A)

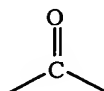


(B)

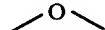


(C)

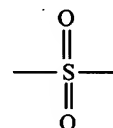
- 10 in which Z is a moiety having a composition selected from the group consisting of formula (L), formula (M), formula (N) and mixtures thereof; and



(L)

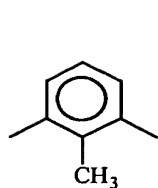


(M)

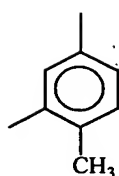


(N)

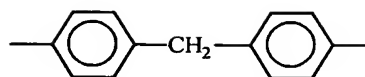
$R_1$  is a moiety having a composition selected from the group consisting of formula (Q), formula (S), formula (T), and mixtures thereof:



(Q)



(S)



(T)

5

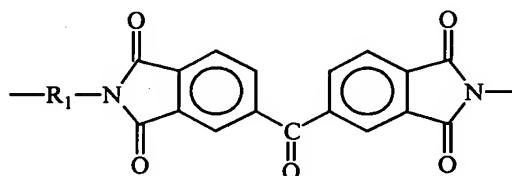
(b) contacting at least the first side of the membrane with a gaseous feed mixture of at least two or more gas components, wherein said mixture comprises at least one C<sub>5+</sub> hydrocarbon component;

10 (c) causing at least one component of the feed mixture to selectively permeate through the membrane, thereby forming on the second side of the membrane a permeate composition which has a concentration of at least one component that is greater than the concentration of the feed mixture;

(d) removing from the second side of the membrane the permeate composition; and

15 (e) withdrawing from the first side of the membrane a composition which has a concentration of at least one component that is less than the concentration of the feed mixture.

28. The method of claim 27, in which the repeating units of formula (I) comprise repeating units of formula (Ia):

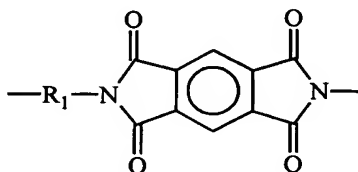


(Ia)

20

- 5        29. The method of claim 28, in which  $R_1$  is comprised of formula (Q) in about 16% of the repeating units, formula (S) in about 64% of the repeating units, and formula (T) in about 20% of the repeating units.

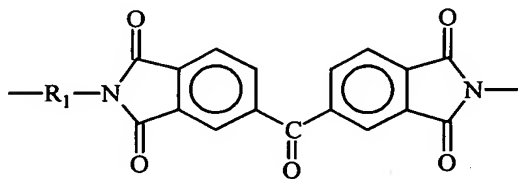
30. The method of claim 27, in which the repeating units of formula (I) comprise repeating units of formula (Ib):



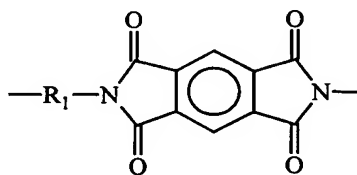
(Ib)

10

31. The method of claim 27, in which the repeating units of formula (I) comprise repeating units having composition of formula (Ia) and repeating units having composition of formula (Ib):



(Ia)



(Ib)

- 15        wherein units of formula (Ib) comprise about 1 – 99% of the total repeating units of formulas (Ia) and (Ib), and in which  $R_1$  is comprised of formula (Q) in about 1-99% of the repeating units, and wherein  $R_1$  is comprised of formula (S) in a complementary amount so as to total 100%.

- 5           32.    The method of claim 31, in which the moiety R<sub>1</sub> has a composition of formula (Q) in about 20% of the repeating units, and wherein the moiety R<sub>1</sub> has a composition of formula (S) in about 80% of the repeating units, and wherein repeating units of formula (Ib) comprise about 40% of the total of repeating units of formulas (Ia) and (Ib) in formula (I).
- 10           33.    The method of claim 27, wherein the driving force for separation comprises a pressure gradient across the membrane of about 0.69 MPa to about 13.8 MPa.
34.    The method of claim 27, wherein said membrane comprises at least two permeators.
35.    The method of claim 34, wherein two permeators are used to separate or  
15   concentrate said gas and wherein the average performance of said permeators is about 3 GPU to about 30 GPU carbon dioxide permeance.
36.    The method of claim 34, wherein two permeators are used to separate or concentrate said gas and wherein the carbon dioxide/nitrogen selectivity ratio is about 10 to about 25.